
Standard Method of Test for

**Specific Gravity and Absorption
of Aggregate by Volumetric
Immersion Method**

AASHTO Designation: T 354-22¹

Technically Revised: 2022

Technical Subcommittee: 1c, Aggregates



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This method covers the determination of bulk and apparent specific gravity and absorption of fine and coarse aggregate at $20 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) for dry and saturated aggregates.
- 1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to consult and establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.*
- 1.3. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 231, Weighing Devices Used in the Testing of Materials
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 76, Reducing Samples of Aggregate to Testing Size
 - R 90, Sampling Aggregate Products
 - T 19M/T 19, Bulk Density ("Unit Weight") and Voids in Aggregate
 - T 84, Specific Gravity and Absorption of Fine Aggregate
 - T 85, Specific Gravity and Absorption of Coarse Aggregate
 - T 255, Total Evaporable Moisture Content of Aggregate by Drying
- 2.2. *ASTM Standards:*
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
 - E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples

- E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standards:*

- IEC 60584-1:2013, Thermocouples - Part 1: EMF specifications and tolerances
- IEC 60751:2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

3. SIGNIFICANCE AND USE

- 3.1. Bulk specific gravity is the characteristic generally used for calculations of the volume occupied by the aggregate in various mixtures containing aggregate including portland cement concrete (PCC), bituminous concrete, and other mixtures that are proportioned or analyzed on an absolute volume basis. Bulk specific gravity is also used in the computation of voids in aggregate in T 19M/T 19. Bulk specific gravity determined on the saturated surface-dry basis is used if the aggregate is wet, that is, if its absorption has been satisfied. Conversely, the bulk specific gravity determined on the oven-dry basis is used for computations when the aggregate is dry or assumed to be dry.
- 3.2. Apparent specific gravity pertains to the relative density of the solid material making up the constituent particles not including the pore space within the particles that is accessible to water. This value is not widely used in construction aggregate technology.
- 3.3. When it is deemed that the aggregate has been in contact with water long enough to satisfy most of the absorption potential, the absorption values are used to represent the change in the mass of an aggregate due to water absorbed into the pore spaces within the constituent particles, compared to the dry condition. The laboratory standard for absorption is that obtained after submerging dry aggregate for approximately 15 h in water. Aggregates mined from below the water table may have a higher absorption when used, if not allowed to dry. Conversely, some aggregates when used may contain an amount of absorbed moisture less than the 15-h soaked condition. For an aggregate that has been in contact with water and that has free moisture on the particle surfaces, the percentage of free moisture can be determined by deducting the absorption from the total moisture content determined by T 255 drying.
- 3.4. Users of this method are encouraged to be cautious in applying the results. Unadjusted values achieved for specific gravity and absorption can be significantly different from those achieved from T 84 and T 85. Results from this method will affect the calculated results for volumetrics in hot mix asphalt (HMA) and absorption in PCC. When using the results from this test for pay factor and/or compliance purposes, the user is required to adjust the absorption and specific gravity values in accordance with Section 13. A graphical method and source/aggregate specific correlation method are shown in Annex B that can be used to correlate results to T84 and T85.

4. APPARATUS

- 4.1. *Flask with Plug for Coarse Aggregate*—A glass flask with a bulb volume of 3000 to 4000 mL and a separate plug. The neck of the flask shall be marked with 5 mL graduated increments that correspond to a precision of at least 0.1 percent of the sample volume. Overall length of the flask is approximately 760 mm (30 in.) (see Note 1 and Figure 1).
- 4.2. *Flask for Fine Aggregate*—A glass flask with a bulb volume of 2000 mL. The neck of the flask shall be marked with 1 mL graduated increments that correspond to a precision of at least

0.1 percent of the sample volume. Overall length of the flask is approximately 760 mm (30 in.) (see Note 1 and Figure 1).

Note 1—The flask to be used for fine aggregate will have a neck approximately 25 mm (1 in.) in diameter. The flask used for coarse aggregate will have a neck approximately 51 mm (2 in.) in diameter.

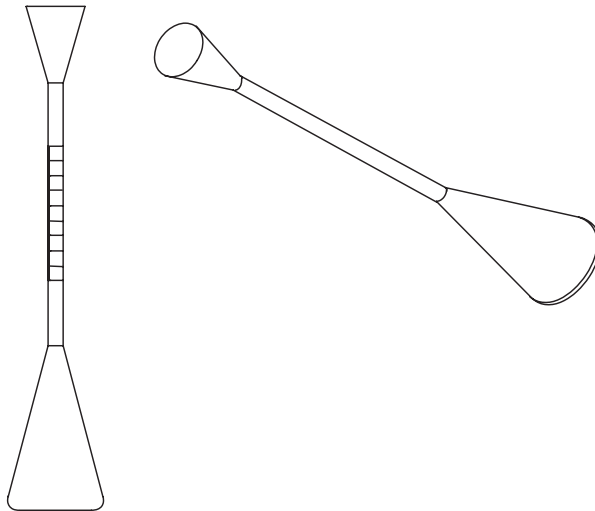


Figure 1—Typical Flask

- 4.3. *Scale with a capacity of at least 10 000 g*—The scale shall comply with the requirements in M 231.
- 4.4. Minimum 450-mm (18-in.) long rod with dry, absorbent swab.
- 4.5. Timer that can be read to the nearest second, and that can measure elapsed time up to 24 h.
- 4.6. *Thermometer*—A thermometer for measuring the temperature of water shall meet the requirements of M 339M/M 339 with a temperature range of at least 15 to 25°C (59 to 77°F), with an accuracy of $\pm 0.25^\circ\text{C}$ ($\pm 0.45^\circ\text{F}$) (see Note 2).
- Note 2**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E879 thermistor thermometer; ASTM E1137/E1137M Pt-100 RTD platinum resistance thermometer, Class A; or IEC 60751:2008 Pt-100 RTD platinum resistance thermometer, Class AA.
- 4.7. *Oven*—An oven of appropriate size capable of maintaining a uniform temperature of $110 \pm 5^\circ\text{C}$ ($230 \pm 9^\circ\text{F}$). Oven(s) for heating and drying shall be capable of operation at the temperatures required, between 100 to 120°C (212 to 248°F), within $\pm 5^\circ\text{C}$ ($\pm 9^\circ\text{F}$), as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the temperature shall meet the requirements of M 339M/M 339 with a temperature range of at least 90 to 130°C (194 to 266°F), and an accuracy of $\pm 1.25^\circ\text{C}$ ($\pm 2.25^\circ\text{F}$) (see Note 3).
- Note 3**—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type J or K, Special Class, Type T any Class; IEC 60584 thermocouple thermometer, Type J or K, Class 1, Type T any Class; or dial gauge metal stem (bi-metal) thermometer.